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(54) Structures

(57) A method of forming an elongate structure having axial load bearing properties such as pylons, radio masts and aerials by use of a former carrying hooks. Pre-cured longitudinal struts 4 of convex curvature are passed through the hooks 3 to form a cigar shaped skeleton. Continuous fibre 5 saturated with resin is then wound spirally around the longitudinal struts from hook to hook. The resin is then allowed to cure and the former removed.

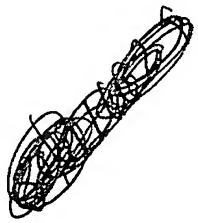
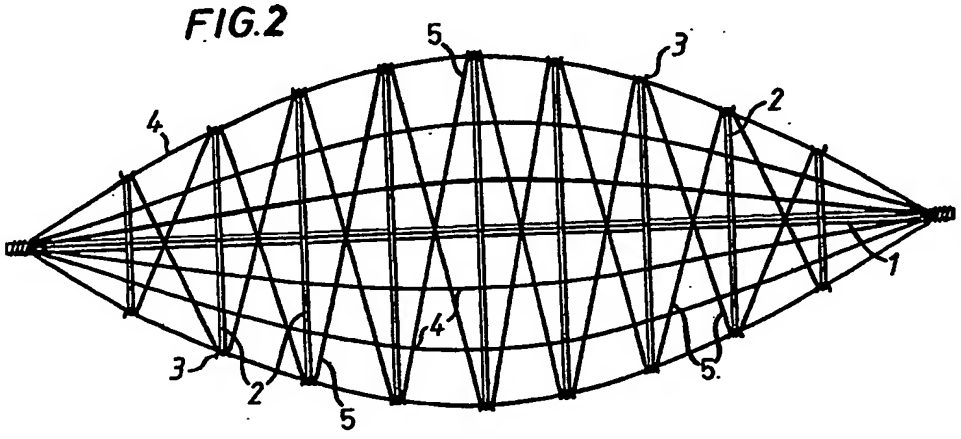


FIG.2



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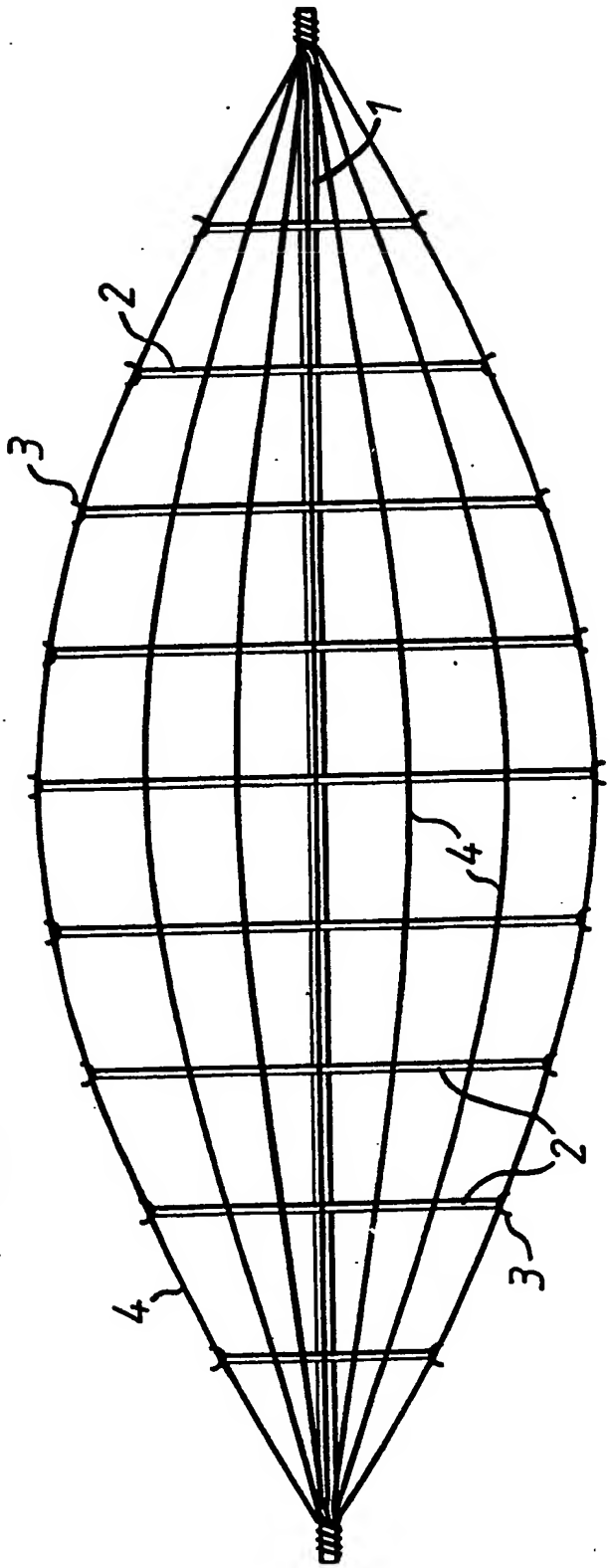

FIG.1

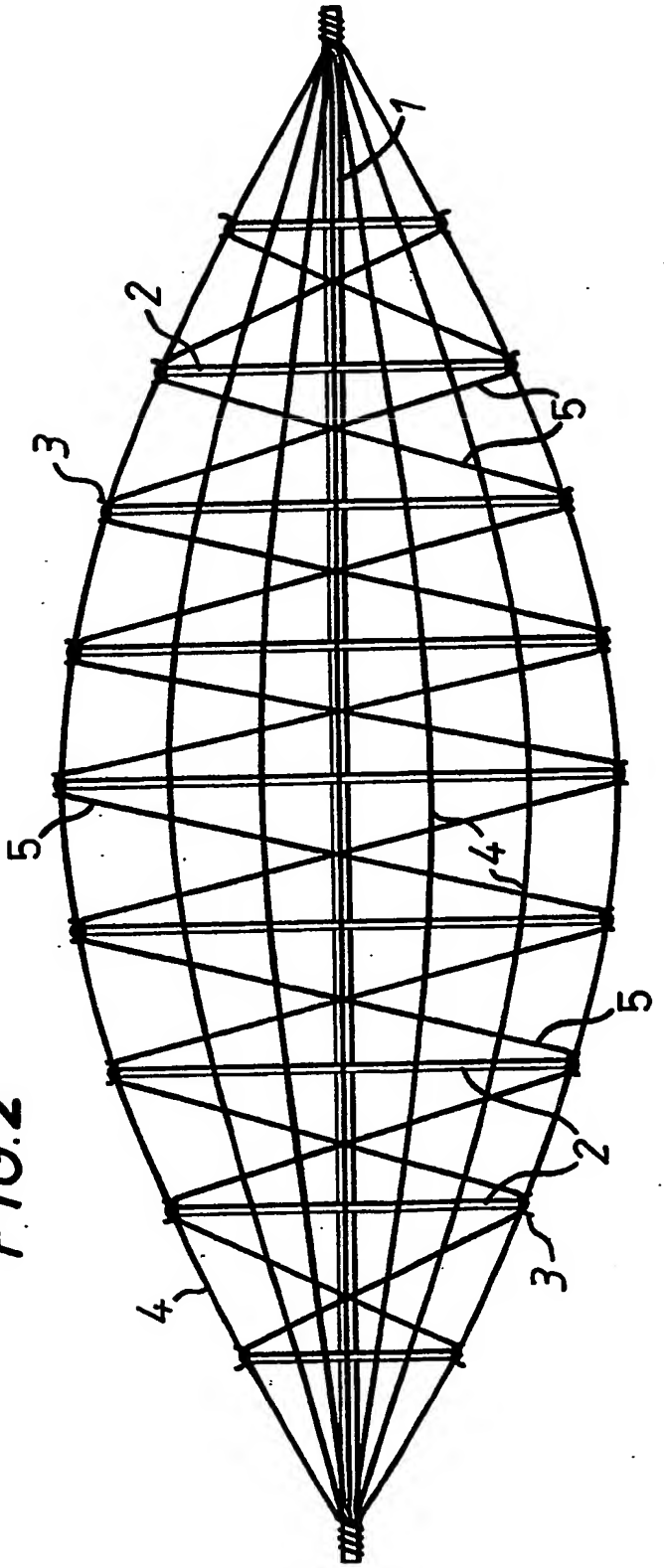

FIG.2

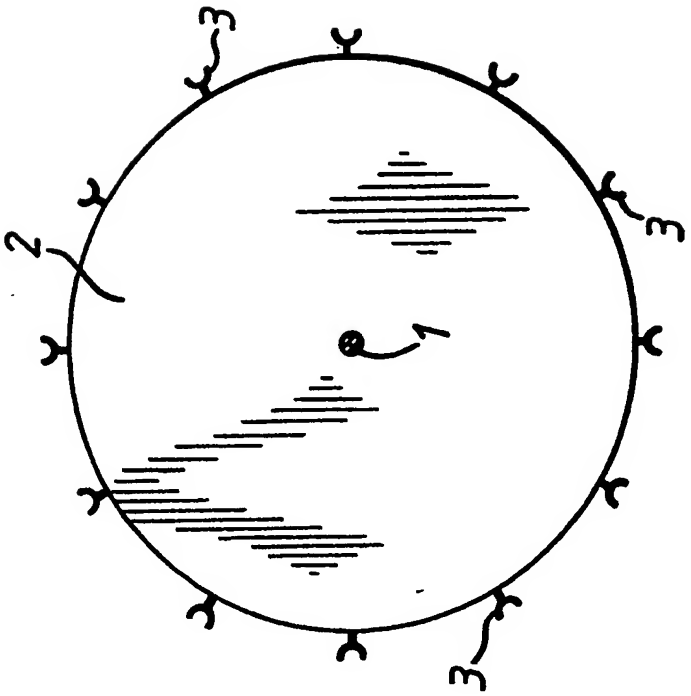

FIG.3

SPECIFICATION

Structures

The present invention relates to the fabrication of structures and more particularly to structures formed by the systematic winding of a resin impregnated strand about a spatially arranged former.

The conventional ways of manufacturing structures such as pylons, aeroplane fuselages, grid structures of bridges, vehicles, machine frames, roof construction, furniture etc, usually involves the use of pre-manufactured rods of material, cutting them to length and connecting the ends to one another until a kind of grid construction is completed. Alternatively, a mould may be used to cast the structure with metal or any suitable material. Or the structure may be produced by cutting a pre-manufactured sheet or board to shape and connecting them with nails or rivets, welding or glueing to produce the desired shape. Those conventional procedures have the disadvantage that materials have to be pre-manufactured, prepared, cut to size and connecting members fitted, e.g. by rivetting or welding, while cast members can only be manufactured by the use of costly and often complicated moulds and furnaces.

GB patent application no. 2004835 A describes a method of winding and curing resin soaked filaments or fibres onto a spatially arranged former to produce a load bearing structure of pre-determined shape. The present invention relates to a further development of this method enabling higher strength pressure struts to be fabricated.

Thus, according to the present invention there is provided a method of forming an elongate structure having axial load bearing capability comprising (a) using a former carrying a plurality of projecting members (b) forming a lattice with longitudinal struts of cured resin saturated fibre having a convex curvature passing from one projecting member to another and (c) subsequent winding strands of fibre saturated with a resin from the projecting members spirally so as to touch and adhere to said cured convex longitudinal struts at a number of points along either length and (e) curing the resin.

Preferably step (b) comprising passing a pre-cured strand or strands of resin saturated fibre adapted to pass from one projecting member to another.

Alternatively step (b) may comprise arranging the former along its horizontal longitudinal axis and laying a strand or strands of resin saturated fibre longitudinally through the lowest projecting members and allowing curing to form a convex curvature. Then the former is rotated through a small angle and the same process repeated so that eventually the periphery of the former takes the form of convex curvature longitudinal struts.

It is essential that the longitudinal struts not only have an overall convex curvature but also have a convex curvature between each pair of projecting members. This is necessary so that when the structure is placed under a compressive load, there is no tendency for the structure to buckle inwards but instead is forced outwards against the restraint of the spiral windings.

Structures wound according to GB patent application no. 2004835 A are generally less strong under compression forces than tensile forces. In a vertical loaded elongate structure fabricated according to the invention, the spiral windings are under tension and the longitudinal beams which would tend to move radially outward are held in place by these spiral windings which effectively split the longitudinal beams into many short lengths which have greater buckling resistance than the unsupported beam.

Structures produced by this method include pylons, radio masts and aerials.

In order to provide further strenghtening of the structure the strands may be alternately wound on the same projection member from different directions, and interwoven at the nodes or crossing points. An interlocked structure is thereby achieved giving the advantage of joints formed monolithically with the ties and struts.

Suitable materials for the manufacture of the structure described above are glass fibre or textile, roving or strands wetted with organic or chemical glues, paints, plastic materials, polythene, epoxy, urethanes, water glass mixed with cement, magnesium oxychloride, polyester resins and other kinds of plastics.

The former or hooks used in building the structures may be left after curing to form an integral part of the structure or may be collapsed and removed.

The invention will now be described by way of example with reference to Figures 1 to 3 of the accompanying drawings.

Figures 1 and 2 show side views of a structure according to the invention, figure 1 showing the structure having convex longitudinal pre-cured struts in position and figure 2 showing the spirally wound continuous resin wetted fibre lying around the pre-cured struts. Figure 3 shows a circular disc carrying hooks which is part of the former.

The drawings illustrate the formation of an elongate structure having a taut steel wire 1 forming a central core. A plurality of substantially circular members 2 having hooks 3 are arranged along the wire 1, the plane of the circular members 2 being at right angles to the length of the wire 1. The circular members 2 decrease in diameter in a direction from the centre of the wire 1 towards its ends. Hooks 3 are also provided at each end of the steel wire 1. Firstly, a pre-cured continuous strand comprising a bundle of glass fibre rovings wetted by passage through a bath of polyester resin was placed in the hooks 3 to produce longitudinal convex strands 4 passing from one end of the wire to the other via each circular member 2 to give an elliptical shape.

Then continuous wetted glass fibre rovings 5 are wound spirally over the cured convex strands and between the hooks 3 of the circular members 2, the rovings touching the cured convex strands at several points between each circular member 2. Thereafter more wetted glass fibre rovings are wound around the hooks of the circular members to build up a symmetrical structure. This process is repeated until all the hooks 3 of the circular members 2 are used and a structure of desired strength obtained.

The continuous strands was produced by passing three continuous bundles of glass fibre rovings through a bath of polyester resin and then through an orifice plate to give roughly uniform strand diameter (not shown). The glass fibre rovings used were Vetrotex (EC14,2400 Tex) produced by St. Gobain Industries (S-22) and each bundle of rovings contained about 208 fibres of about 10 microns diameter. The polyester resin used was Cellobond A2785 CV (BP Chemicals Ltd.) using MEX peroxide catalyst and 0.6% cobalt solution as accelerator. The formulations were chosen so that easy wetting of the fibre occurred but with sufficient viscosity to reduce run-off tendency. Also it is desirable that a suitable resin gelation time should be chosen, after winding, the structures were allowed to cure at room temperature for several hours, depending on the formulation.

CLAIMS

1. A method of forming an elongate structure having axial load bearing capability comprising (a) using a former carrying a plurality of projecting members (b) forming a lattice with longitudinal struts of cured resin saturated fibre having a convex curvature passing from one projecting member to another (c) subsequently winding a continuous fibre saturated with a resin from the projecting members spirally so as to touch and adhere to said cured convex longitudinal struts at a number of points along their length and (e) curing the resin.

2. A method according to claim 1 in which the longitudinal struts are made of pre-cured continuous strands or strands of resin saturated fibre adapted to pass from one projecting member to another.

3. A method according to claim 1 in which a longitudinal strut is formed by arranging the former along its horizontal longitudinal axis, laying a strand or strands or resin saturated fibre longitudinally through the lowest projecting members and allowing curing to form the convex curvature, the former being subsequently partially rotated about the longitudinal axis to allow further longitudinal struts of convex curvature to be formed in the same manner.

4. A method according to any of the preceding claims in which the continuous fibre is further passed around at least certain of the projecting members to produce the desired fibre thickness between the projecting members to thereby selectively reinforce the structure.

5. A method according to any of the preceding claims in which the continuous fibre is repeatedly strung between pairs of projecting members so as to produce interweaving at their nodes or crossing points.

6. A method according to any of the preceding claims in which at least some of the projecting members are hooks or U-shaped members.

7. A method according to any of the preceding claims in which the former is removable from the structure subsequent to curing.

8. A method according to any of the preceding claims in which the continuous fibre is glass fibre or a textile roving.

9. A method according to any of the preceding claims in which the resin is a polyester resin.

10. A method as hereinbefore described and with reference to the accompanying drawing.

11. Structures whenever made according to any of claims 1 to 10.

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